Annals of Clinical and Analytical Medicine
Original Research

The effect of glucocorticoid use in rheumatoid arthritis patients: Good or bad?

Zeynep Aykin Yigman, Ebru Umay
Department of Physical Medicine and Rehabilitation, University of Health Sciences, Ankara Etlik Integrated Health Campus, Ankara, Turkey

Abstract

Aim: In this study, our aim was to evaluate the relationship between the use of glucocorticoid (GC) therapy at any stage of Rheumatoid Arthritis (RA) and disease activity, functional status, and comorbidities.

Material and Methods: Our study, included 194 patients followed up with the diagnosis of RA. Demographic characteristics of the patients, duration and dose of GC use, laboratory results, general health perception, disease activity score-28 (DAS-28) and modified Health Assessment Questionnaire (m-HAQ) values were recorded by scanning their files. The Ppatients were divided into 3 groups: as those who currently use using GC, those who had used using GC in the past, and those had never used never using GC. The relationship between GC use and assessment parameters was investigated between the three groups.

Results: General health perception was better in GC users. M-HAQ value was worse in GC users. A positive correlation was observed between the use of GC and the presence of additional diseases, the occurrence of sensitive joints, the patient's general health perception, and m-HAQ, while a negative correlation was noted with DAS-28. Additionally, the regression analysis revealed that the use of GC was associated with an increase in the occurrence of additional diseases, a rise in the number of sensitive joints and m-HAQ values, and a decrease in the DAS-28 value.

Discussion: While the use of glucocorticoids in patients with rheumatoid arthritis reduces disease activity, it might have a negative impact on the individual's functional status and increase the risk of additional diseases. We believe that the potential adverse effects attributed to glucocorticoids can be reduced by following guidelines and considering patient-specific factors before and throughout the treatment course.

Keywords

Rheumatoid Arthritis, Glucocorticoids, Comorbidity, Disease Severity

DOI: 10.4328/ACAM.21914 Received: 2023-08-28 Accepted: 2023-10-12 Published Online: 2023-10-14 Printed: 2023-10-15 Ann Clin Anal Med 2023;14(Suppl 3):S306-310
Corresponding Author: Zeynep Aykin Yigman, Department of Physical Medicine and Rehabilitation, University of Health Sciences, Ankara Etlik Integrated Health Campus, Ankara, Turkey.
E-mail: zynpaykn@gmail.com P: +90 507 778 34 94 F: +90 312 630 30 31
Corresponding Author ORCID ID: https://orcid.org/0000-0001-6333-8779
This study was approved by the Ethics Committee of the University of Health of Sciences, Dıskapı Training and Research Hospital (Date: 2021-04-19, No: 109/25)

Introduction

Rheumatoid arthritis (RA) is a chronic inflammatory disease and can cause joint damage, dysfunction, disability, and premature death [1]. The main goals of effective treatment in rheumatoid arthritis are to relieve symptoms and prevent the development of damage. Although many patients are now using disease-modifying antirheumatic drugs (DMARDs), glucocorticoids (GC) are still widely used in the treatment of RA.

Symptoms of RA, such as joint pain and functional disability, are usually severe in the early morning hours and are the result from of altered inflammatory and neuroendocrine activities [2]. Therefore, GC therapy in RA is recommended at low doses, as it may partially act as a 'replacement therapy' in the presence of reduced endogenous cortisol [3].

Glucocorticoids have a well-established history of efficacy, displaying strong and rapid anti-inflammatory as well as immunosuppressive effects in the treatment of RA. This history has led to their inclusion in RA treatment guidelines [3-6]. A systematic review assessed the disease-modifying effects of GC and observed their combination with DMARDs in the majority of studies [7]. Administered at low doses during the early stages of the disease, GC hasve shown significant improvements in structural outcomes among patients with RA [8].

The clinical efficacy of GC depends on factors such as the route of administration, absorption rate, solubility, metabolic rate, and dosage [9]. Therapeutic effects increase with higher dosages; however, due to an unfavorable benefit/risk ratio, high-dose GC therapy is no longer recommended for RA [10]. While GC should be used cautiously in patients with RA, studies indicate that when combined with DMARDs at low doses, they improve quality of life, alleviate symptoms, reduce synovial inflammation, and slow the progression of radiological joint damage [11, 12]. Despite the undeniable benefits of GCs in treating RA, even at low doses, they can cause come with the potential for serious side effects, sinceas they can affect various organs differently [13, 14]. As a result, concerns about side effects persist among both patients and physicians when using GCs [11, 15].

In this study, our aim was to evaluate the relationship between the use of GC therapy at any stage of RA and disease activity, functional status, disease severity, and comorbidities.

Material and Methods

Study Design

The study includedThe 194 patients with the diagnosis of RA according to the criteria of the American Rheumatism Association, and who attended outpatient clinics for follow-up visits were included in the study [15]. Patients' files have been examined as retrospectively.

The study was approved by the Ethics Committee of the Hospital (approval number: 109/25 date: 19-04-2021). All procedures were conducted according toby the relevant principles of the 2004 Helsinki Declaration.

The inclusion criteria defined individuals aged 18 to 75 years with a confirmed diagnosis of Rheumatoid Arthritis for a minimum of 1 year. On the other hand, exclusion criteria were defined to exclude those with a history of inflammatory and connective tissue diseases other than Rheumatoid Arthritis, a history of malignancy, progressive or non-progressive nervous system diseases, and individuals who had previously used anti-TNF medication.

Demographic and disease characteristics

Demographic characteristics of the patients, including age, gender, educational status, additional comorbidities, disease duration, number of tender and swollen joints in the last examination, the patient's general health assessment (PGA-measured on a scale of 0-100 mm), medications used, GC use status, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), Rheumatoid factor (RF), and anti-cyclic citrullinated peptide (anti-CCP) levels, were documented. To classify GC use, the presence of at least 5 mg prednisolone usage for a minimum of 3 months was investigated.

Disease activity of patients wasere calculated using theby disease activity score-28 (DAS-28) by using a number of tender and swollen joints and the patient's general health assessment score as well as ESR level [16].

The patients' functional status was assessed using the modified Health Assessment Questionnaire (m-HAQ), which comprises 8 items designed to measure patients' levels of disability in their daily activities. Higher scores on this scale indicate poorer health [17].

Study protocol

The patients were categorized into three groups: those who currently using GCs now, those who had used GCs in the past, and those who had never used GCs. The Eevaluation parameters were then assessed to determine the relationship between GC use and these parameters across the three groups.

Statistical analysis

Data analyses were performedmade using the Statistical Package for the Social Sciences (SPSS) 22.0 for Windows. The Ccontinuous variables were evaluated with the Kolmogorovw-Smirnovw test as to whether or not they were different from normal distribution. Descriptive statistics were shown as mean ± standard deviation (SD) for continuous variables and frequencies and percentages (%) for nominal and categorical variables. The sSignificance of the differences among the groups with and without corticosteroids was investigated with the ANOVA test with Bbonferroni correction post hoc analysis. The relationship between corticosteroid use and the presence of comorbidity and disease characteristics was evaluated with the Pearson's (for continuous variables) and Spearman's rho (for nominal variables) correlation test. For significantly correlation, multivariate regression analysis was performed. The Rresults were considered as significant for at $p<0.05$.

Ethical Approval

Ethics Committee approval for the study was obtained.

Results

The mean age of the patients enrolled in the study was 56.61±11.49 years. Among the patients, 86.6% (n=168) were female, while 13.4% (n=26) were male. The most prevalent comorbidity was peptic ulcer (n=49, 25.3%), followed by hypertension (n=44, 22.7%). The majority of patients exhibited a solitary comorbidity (n=53, 54.1%).

Additional diseases were present in 98 (50.5%) of the patients. The most common comorbidity was peptic ulcer (n=49, 25.3%),

Table 1. Comparison of demographic and disease characteristics of GC users and nonusers patients using and not using GCs.

		GC-now N=42	GC-past N=56	GC-never N=96	GC-now/ GC-past p	GC-now/ GC-never p	GC-past/GC-never p
Age (year) mean±SD		56.17± 9.61	59.38± 8.48	52.57± 11.64	0.891	0.124	0.058
Additional diseases n(%)	Number of patients with comorbidity	24 (57.1)	48 (57.1)	26 (27.0)	0.601	0.022	0.027
	1 additional disease	16 (38.1)	22 (39.3)	15 (15.5)			
	2 additional disease	4 (9.4)	10 (17.9)	9 (9.4)			
	≥3 additional disease	4 (9.4)	16 (28.6)	2 (2.1)			
Disease duration (year) mean±SD		15.35±4.80	16.37± 4.62	10.76± 3.44	0.739	0.061	0.052
Number of tender joints (0-28) mean±SD		3.32±0.42	3.39±1.01	3.08±0.60	0.573	0.116	0.093
Number of swollen joints (0-28) mean±SD		2.66±0.81	2.71±0.20	2.58±0.59	0.586	0.513	0.22
PGA (0-100 mm) mean±SD		38.05±4.17	49.57± 5.66	30.26± 3.12	0.004	0.033	0.001
DAS 28 score mean±SD		3.24±0.42	3.55±0.53	2.76±0.35	0.372	0.086	0.057
ESR level (mm/hour) (0-20) mean±SD		27.48±3.16	29.90± 4.07	21.56± 2.49	0.29	0.263	0.073
CRP (µg/dl) (0-5) mean±SD		8.73±2.07	9.08±3.92	7.85±2.08	0.379	0.215	0.082
RF (IU/mL) (0-20) mean±SD		85.72±8.44	84.13± 19.71	60.74± 13.06	0.873	0.001	0.001
Anti-CCP (U) (0-20) mean±SD		29.08± 8.86	28.73± 9.83	26.43± 4.83	0.539	0.256	0.223
m-HAQ (0-3) mean±SD		2.18±0.52	2.54± 0.41	1.60± 0.48	0.493	0.026	0.011

SD: standard deviation, DAS 28: disease activity score 28, ESR: Eryithrocyte sedimentation rate, CRP: C-Reactive protein, RF: Rheumatoid factor, Anti-CCP: anti-cyclic citrullinated peptide, m-HAQ: modified health assessment questionnaire., PGA: patient general health assessment. GC-now:Patients currently using glucocorticoids, GC-past: Patients who have used glucocorticoids in the past, GC-never: Patients who have never used glucocorticoids

Table 2. Correlation analysis between GC use and demographic and disease characteristics.

	n=194 r/p
Presence of comorbidity	0.352/0.007♠
Disease duration (year)	0.129/0.075*
Number of tender joints	0.317/0.011*
Number of swollen joints	0.110/0.128*
PGA	0.164/0.023*
DAS 28	-0.256/0.012*
ESR (mm/hour)	0.088/0.226*
CRP (µg/dl)	0.114/0.115*
RF (IU/mL)	0.171/0.020*
Anti-CCP (U)	0.032/0.776*
m-HAQ	0.240/0.006*

r: Pearson's correlation coefficient; DAS-28: disease activity score-28, ESR: Eryithrocyte sedimentation rate, CRP: C-Reactive protein, RF: Rheumatoid factor, Anti-CCP: anti-cyclic citrullinated peptide, m-HAQ: modified health assessment questionnaire., PGA: patient general health assessment. ♠:Spearman's rho correlation test, * : Pearson's correlation test

Table 3. Multivariate regression analysis of significantly correlation for GC use.

	β	SE	P value	95 CI (lower -upper bound)
Presence of comorbidity	0.113	0.005	0.009	0.002-0.598
Number of tender joints	0.592	0.21	0.006	0.174-1.010
PGA	0.26	0.148	0.054	0.032-0.551
DAS-28	-0.207	0.502	0.034	-1.207-0.794
RF	0.058	0.01	0.337	0.009-0.257
m-HAQ	0.007	0.209	0.03	-0.460-0.420

95% CI: 95% confidence interval; SE: standard error; PGA: patient general health assessment, DAS-28: disease activity score 28, RF: Rheumatoid factor, m-HAQ: modified-Health Assessment Questionnaire

followed by hypertension (n=44, 22.7%), COPD/asthma (n=20, 10.3%), hypothyroidism (n=19, 9.8%), diabetes mellitus (n=13, 6.7%), hyperlipidemia (n=12, 6.2%), osteoporosis (n=11, 5.7%), cardiac disease (n=6, 3.1%), chronic renal failure (n=2, 1.0%), and hepatitis B carrier (n=2, 1.0%). The majority of patients had a singleone comorbidity (n=53, 54.1%), while 10 (10.2%) had 2 comorbidities and 35 (35.7%) had 3 or more comorbidities.

The outcomes of the evaluation concerning the participants' disease characteristics were determined as follows: the mean±SD disease duration was 12.72±3.95 years, the mean±SD count of tender joints was 3.35±0.59, the mean±SD count of swollen joints was 2.67±0.66, the mean±SD patient general health assessment score was 32.44±3.65, the mean±SD DAS-28 scores were 3.01±0.64, the mean±SD ESR level was 24.07±4.01 mm/hour, the mean±SD RF level was 64.84±15.23 IU/mL, the mean±SD Anti-CCP level was 28.05±9.22 U, and the mean±SD m-HAQ score was 1.93±0.16.

Out of the total number of participants, 192 (99.0%) patients were utilizing Non-Steroidal Anti-Inflammatory Drugs, 170 (87.6%) were employing Methotrexate, 169 (87.1%) were utilizing Sulfasalazine, 83 (47.8%) were employing Hydroxychloroquine, 52 (26.8%) were utilizing Leflunomide, and 98 (50.5%) were employing GC (Prednisolone).

While 96 patients (49.5%) did not use any GCs, 98 patients (50.5%) utilized GCs. Among these 98 patients, 42 (42.9%) were still using GCs (mean dose 6.02 ± 0.87 mg prednisolone), while 56 (57.1%) were not currently using GCs at a certain stage of the disease (mean dose 11.52±3.16 mg prednisolone). A comparison of the demographic and disease characteristics among patients currently using GCs (n=42), those who used them in the past (n=56), and non-users (n=96) is presented in Table 1.

The presence of comorbidity in the groups using GCs (p=0.022, p=0.027) was higher than in the group not using GCs. General

health assessment was highest in the group that had used GCs previously and lowest in the group that had never used GCs, and a significant difference was observed among all groups. High RF (p=0.001, p=0.001) levels and the presence of functional disability (p=0.011, p=0.026) were significantly higher in the glucocorticoid-used groups compared to the non-user groups.

The relationship between the use of GCs and the disease characteristics of the patients is presented in Table 2. Glucocorticoid use exhibited a positive correlation with the presence of comorbidity (p=0.027), the number of tender joints (p=0.011), PGA (p=0.023), RF (p=0.020), and m-HAQ (p=0.006), whereas the DAS-28 score showed a negative correlation (p=0.012).

In the multivariate regression analysis conducted to assess significant correlations, it was determined that the use of GCs was associated with the presence of comorbidity (p=0.009), an increased number of tender joints (p=0.006), and increasedheightened functional disability (p=0.030), while exhibiting a decrease in the DAS-28 score (p=0.034) (Table-3).

Discussion

In this study, patients were categorized into three groups based on their GC usage status. Participants with a history of GC use had a higher prevalence of additional diseases. Glucocorticoid users reported improved general health perception, but displayed worse RF and HAQ values. Furthermore, a positive correlation was identified between GC use and the presence of additional diseases, sensitive joints, PGA, RF, HAQ, while a negative correlation was noted with DAS-28. Additionally, the regression analysis demonstrated an association between GC use and increased occurrence of additional diseases, a higher number of sensitive joints and HAQ values, alongside a decreased DAS-28 score. We discuss the potential implications of our findings below.

Remission stands out as the primary therapeutic objective in treating RA [4, 6]. Research indicates that incorporating GC therapy into the treatment regimen for RA patients can enhance the likelihood of achieving disease remission [12, 18, 19]. Furthermore, insights from long-term follow-up studies (spanning over 2 years) underscore the sustained disease-modifying effects of treatment approaches involving GC combination therapy. These effects encompass diminished disease activity, reduced erosive joint damage and radiographic progression, improved DAS-28 and HAQ values, as well as attaining and maintaining remission [12, 19-21]. Nevertheless, in a distinct study concerning patients with early RA (<1 year), prednisone at 10 mg/day exhibited superiority over a placebo in enhancing general well-being at 3 and 6 months, yet this difference was not sustained at the 2-year follow-up mark [22].

In our investigation, while the use of GCs positively impacted DAS-28 and general health perception, it was evident that it had an adverse effect on functional status and the number of tender joints. The inclusion of patients with established RA in our study, coupled with a relatively high mean disease duration (12.72±3.95), may have contributed to the worsening of functional status, increasedheightened disability, and elevated HAQ values due to the emergence of permanent deformities over time. While periodic GC use is essential for patients with a severe disease trajectory and offers respite during its implementation, an aggregate assessment suggests potential degradation in functional status over time.

Though a negative correlation existed between GC use and DAS-28, a positive correlation was identified with joint tenderness. The rise in tender joints, despite the decrease in disease activity, implies that joint tenderness might stem from chronic joint damage rather than disease activity itself. Likewise, even with low DAS-28 values, the presence of high HAQ values implies that functionality is impaired due to the persistent damage from RA.

The clinical applicability of RF in monitoring disease activity and therapy response is constrained [23, 24]. Elevated RF levels may signify aggressive joint involvement, rheumatoid nodules, and extraarticular involvement [23, 24]. The disease's aggressive course might have led to heightened RF levels, potentially necessitating periodic GC use. Hence, a positive correlation was noted between GC use and elevated RF levels.

Regression analysis unveiled an association between GC use and an elevated presence of comorbidities. Besides the favorable effects, GC usage also entails detrimental impacts on various organs and increasesheightens the risk of further diseases over long-term use. Consequently, individuals at a higher risk of comorbid diseases should undergo more stringent monitoring during GC administration.

Limitations

The primary limitation of this study lies inis its cross-sectional design, which may result in participants not sharing the same disease characteristics as those found in community-treated patients. This divergence could potentially limit the generalizability of the study's findings. While study results are typically reported as mean values, it 'is important to note that not all patients respond uniformly to glucocorticoid treatment. Patients in routine clinical practice may exhibit reduced activity and a diminished risk of deterioration as a consequence.

Another constraint pertains to the challenge of conducting a comprehensive evaluation of GC exposure duration and dosage. Information regarding GC use was extracted from patient records, a method fraught with several potential limitations encompassing accuracy, data gaps, and documentation errors.

Conclusion

Consequently, a significant number of patients receive prolonged GC treatment. EULAR recommends initiating GC therapy in early RA only when clinically indicated and for a duration of up to 6 months [4]. However, it is plausible that a majority of patients undergo GC treatment for considerably longer periods. When assessing the actual extent of harm stemming from GC treatment, it 'is essential to consider patient-specific factors —such as age, gender, genetic predisposition, comorbidities, and individual lifestyle factors (such as smoking, alcohol consumption, diet, or physical exercise) —both before and during GC treatment. By adhering to established guidelines and recommendations and approaching each patient as an individual, the potential risks of adverse effects associated with conventional GC therapy in treating RA can be minimized.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement
All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Funding: *None*

Conflict of Interest
The authors declare that there is no conflict of interest.

References
1. McInnes, I.B, . and G. Schett G. The pathogenesis of rheumatoid arthritis. N Engl J Med Overseas Ed. 2011; 365(23): 2205-19.
2. Buttgereit, F., G.R. Burmester GR, R.H. Straub RH, M.J. Seibel, MJ and H. Zhou H. Exogenous and endogenous glucocorticoids in rheumatic diseases. Arthritis Rheum. 2011; 63(1): 1-9.
3. Smolen, J.S., R.B. Landewé RB, J.W. Bijlsma JW, G.R. Burmester GR, M. Dougados M,. A. Kerschbaumer A, et al. EULAR recommendations for the management of rheumatoid arthritis with synthetic and biological disease-modifying antirheumatic drugs: 2019 update. Ann Rheum Dis. 2020; 79(6): 685-99.
4. Smolen, J.S., R. Landewé R, F.C. Breedveld FC, M. Buch M, G. Burmester G, M. Dougados M, et al. EULAR recommendations for the management of rheumatoid arthritis with synthetic and biological disease-modifying antirheumatic drugs: 2013 update. Ann Rheum Dis. 2014; 73(3): 492-509.
5. Duru, N., M. Van Der Goes M, J. Jacobs J, T. Andrews T, M. Boers M, F. Buttgereit F, et al. EULAR evidence-based and consensus-based recommendations on the management of medium to high-dose glucocorticoid therapy in rheumatic diseases. Ann Rheum Dis. 2013; 72(12):1905-13.
6. Bykerk, V.P., P. Akhavan P, G.S. Hazlewood GS, O. Schieir O, A. Dooley A, B. Haraoui B, et al. Canadian Rheumatology Association recommendations for pharmacological management of rheumatoid arthritis with traditional and biologic disease-modifying antirheumatic drugs. J Rheumatol. 2012; 39(8): 1559-82.
7. Ferreira, J.F., A.A.A. Mohamed AAA, and P. Emery P. Glucocorticoids and rheumatoid arthritis. Rheum Dis Clin North Am. 2016; 42(1): 33-46.
8. Jacobs, J.W. Lessons for the use of non-biologic anchor treatments for rheumatoid arthritis in the era of biologic therapies. Rheumatology. 2012; 51(Ssuppl._4): iv27S27-33.
9. Luis, M., M. Boers M, K. Saag K, F. Buttgereit F, and J.A. da Silva JA. The safety of glucocorticoids in the treatment of inflammatory rheumatic disease: new evidence. Curr Opin Rheumatol. 2022; 34(3):179-86.
10. Mercieca, C,. and J.R. Kirwan JR. The intelligent use of systemic glucocorticoids in rheumatoid arthritis. Expert Rev Clin Immuno. 2014; 10(1):143-57.
11. Kavanaugh, A,. and A.F. Wells AF. Benefits and risks of low-dose glucocorticoid treatment in the patient with rheumatoid arthritis. Rheumatology. 2014; 53(10):1742-51.
12. Bakker, M.F., J.W. Jacobs JW, P.M. Welsing PM, S.M. Verstappen SM, J. Tekstra J, E. Ton E, et al. Low-dose prednisone inclusion in a methotrexate-based, tight control strategy for early rheumatoid arthritis: a randomized trial. Ann Intern Med. 2012; 156(5): 329-39.
13. Kirwan, J.R. and F. Buttgereit F. Symptom control with low-dose glucocorticoid therapy for rheumatoid arthritis. Rheumatology. 2012; 51(Ssuppl. _4): iv14S14-21.
14. Rau, R. Glucocorticoid treatment in rheumatoid arthritis. Expert Opin Pharmacother. 2014; 15(11): 1575-83.
15. Aletaha, D., T. Neogi T, A.J. Silman AJ, J. Funovits J, D.T. Felson DT, C.O. Bingham III CO, et al. 2010 rheumatoid arthritis classification criteria: an American College of Rheumatology/European League Against Rheumatism collaborative initiative. Arthritis Rheum. 2010; 62(9): 2569-81.
16. Prevoo, M., M.A. Van'T Hof MA, H. Kuper H, M. Van Leeuwen M, L. Van De Putte L, and P. Van Riel P. Modified disease activity scores that include twenty eight joint counts development and validation in a prospective longitudinal study of patients with rheumatoid arthritis. Arthritis Rheum. 1995; 38(1): p. 44-48.
17. Wolfe, F,. and K. Michaud K. Heart failure in rheumatoid arthritis: rates, predictors, and the effect of anti–tumor necrosis factor therapy. Arthritis Rheum. 2004; 50(10): 3296-305.
18. Montecucco, C., M. Todoerti M, G. Sakellariou G, C.A. Scirè CA, and R. Caporali R. Low-dose oral prednisone improves clinical and ultrasonographic remission rates in early rheumatoid arthritis: results of a 12-month open-label randomised study. Arthritis Res Ther. 2012; 14(3): 1-9.
19. Todoerti, M., C.A. Scirè CA, N. Boffini N, S. Bugatti S, C. Montecucco C, and R. Caporali R. Early disease control by low-dose prednisone comedication may affect the quality of remission in patients with early rheumatoid arthritis. Ann N Y Acad Sci. 2010; 1193(1): 139-45.
20. Klarenbeek, N.B., M. Güler-Yüksel M, S.M. van der Kooij SM, K.H. Han KH, H.K. Ronday HK, P.J. Kerstens PJ, et al. The impact of four dynamic, goal-steered treatment strategies on the 5-year outcomes of rheumatoid arthritis patients in the BeSt study. Ann Rheum Dis. 2011; 70(6):1039-46.
21. van Tuyl, L.H., M. Boers M, W.F. Lems WF, R.B. Landewé RB, H. Han H, S. van der Linden S, et al. Survival, comorbidities and joint damage 11 years after the COBRA combination therapy trial in early rheumatoid arthritis. Ann Rheum Dis. 2010; 69(5): 807-12.
22. Van Everdingen, A.A., D.R. Siewertsz Van Reesema DR, J.W. Jacobs JW, and J.W. Bijlsma JW. The clinical effect of glucocorticoids in patients with rheumatoid arthritis may be masked by decreased use of additional therapies. Arthritis Care Res. 2004; 51(2):233-38.
23. Barra, L., V. Bykerk V, J.E. Pope JE, B.P. Haraoui BP, C.A. Hitchon CA, J.C. Thorne JC, et al. Anticitrullinated protein antibodies and rheumatoid factor fluctuate in early inflammatory arthritis and do not predict clinical outcomes. J Rheumatol. 2013; 40(8): 1259-67.
24. Tillmann, T., R. Krishnadas R, J. Cavanagh J, and K. Petrides K. Possible rheumatoid arthritis subtypes in terms of rheumatoid factor, depression, diagnostic delay and emotional expression: an exploratory case-control study. Arthritis Res Ther. 2013; 15(2): 1-11.

How to Cite This Article:
Zeynep Aykin Yigman, Ebru Umay. *The effect of glucocorticoid use in rheumatoid arthritis patients: Good or bad? Ann Clin Anal Med 2023;14(Suppl 3):S306-310*

This study was approved by the Ethics Committee of the University of Health of Sciences, Dıskapı Training and Research Hospital (Date: 2021-04-19, No: 109/25)